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(54) Video processing system for displaying and editing video clips

(57) An electronic video processing system comprises a store for storing data defining plural video clips, and a processor for selecting from the stored video clips a plurality of clips and for selectively combining data defining the selected clips to form data defining a video story. A plurality of representative frames 55 respectively representing selected video edits is displayable to portray a portion of the video story together with coloured strips 62 which indicate the position within a displayed clip of the respective frames. Also, for each selected clip, a frame representative thereof is displayable together with a pair of smaller frames 73, 74 derived from the first and last frames of the clip.

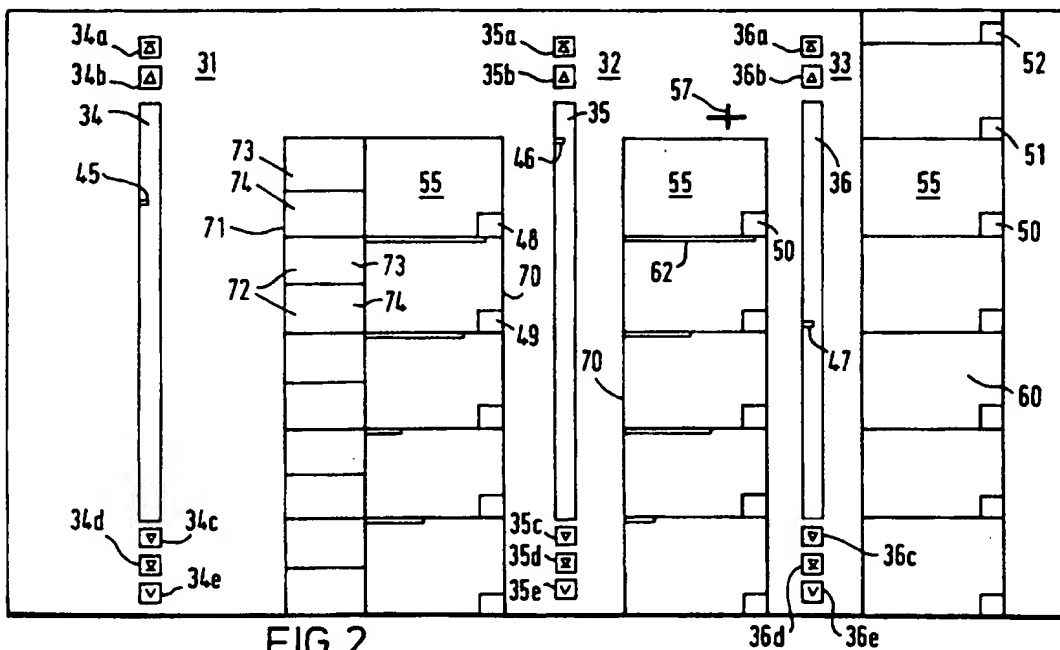
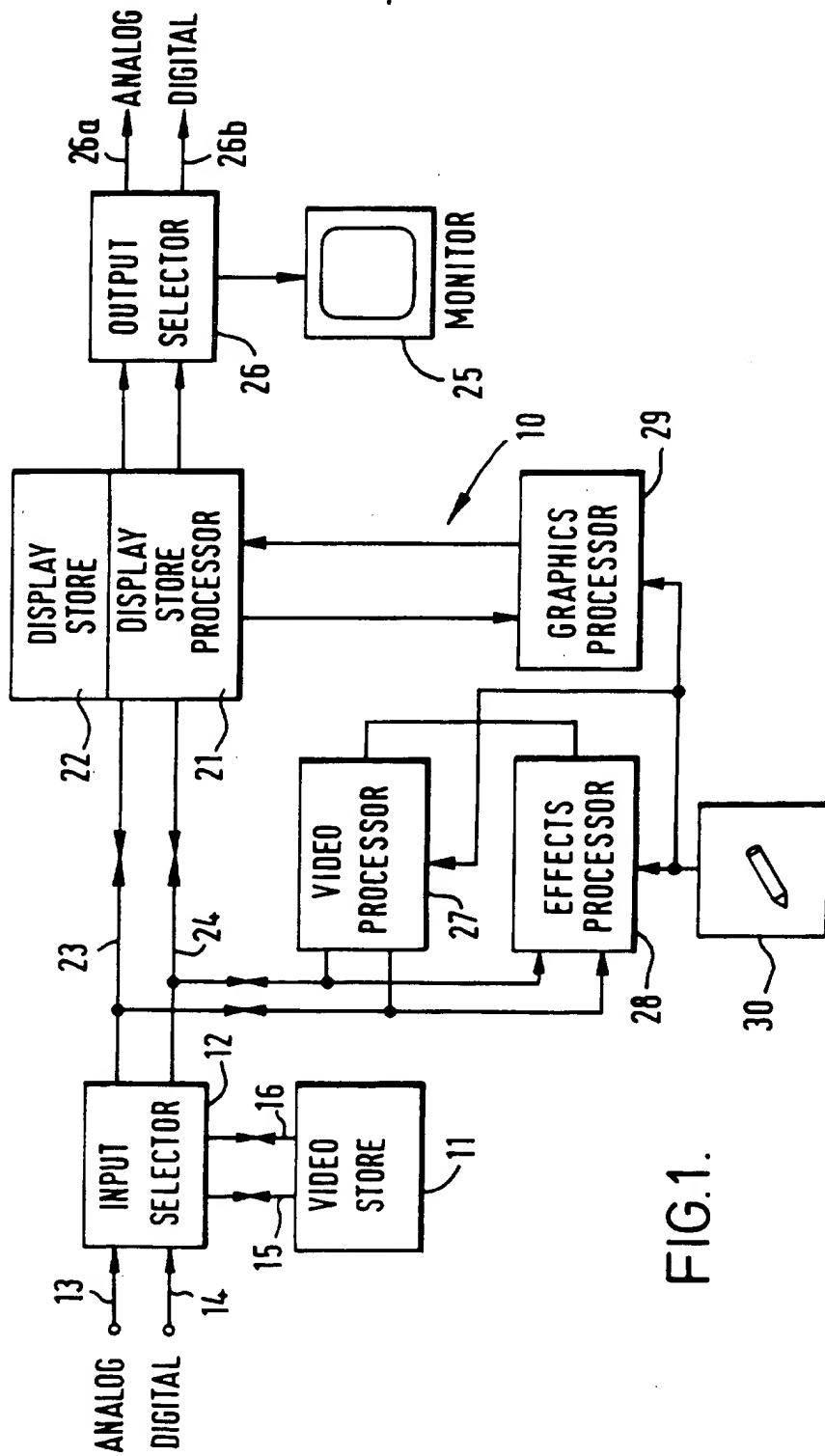
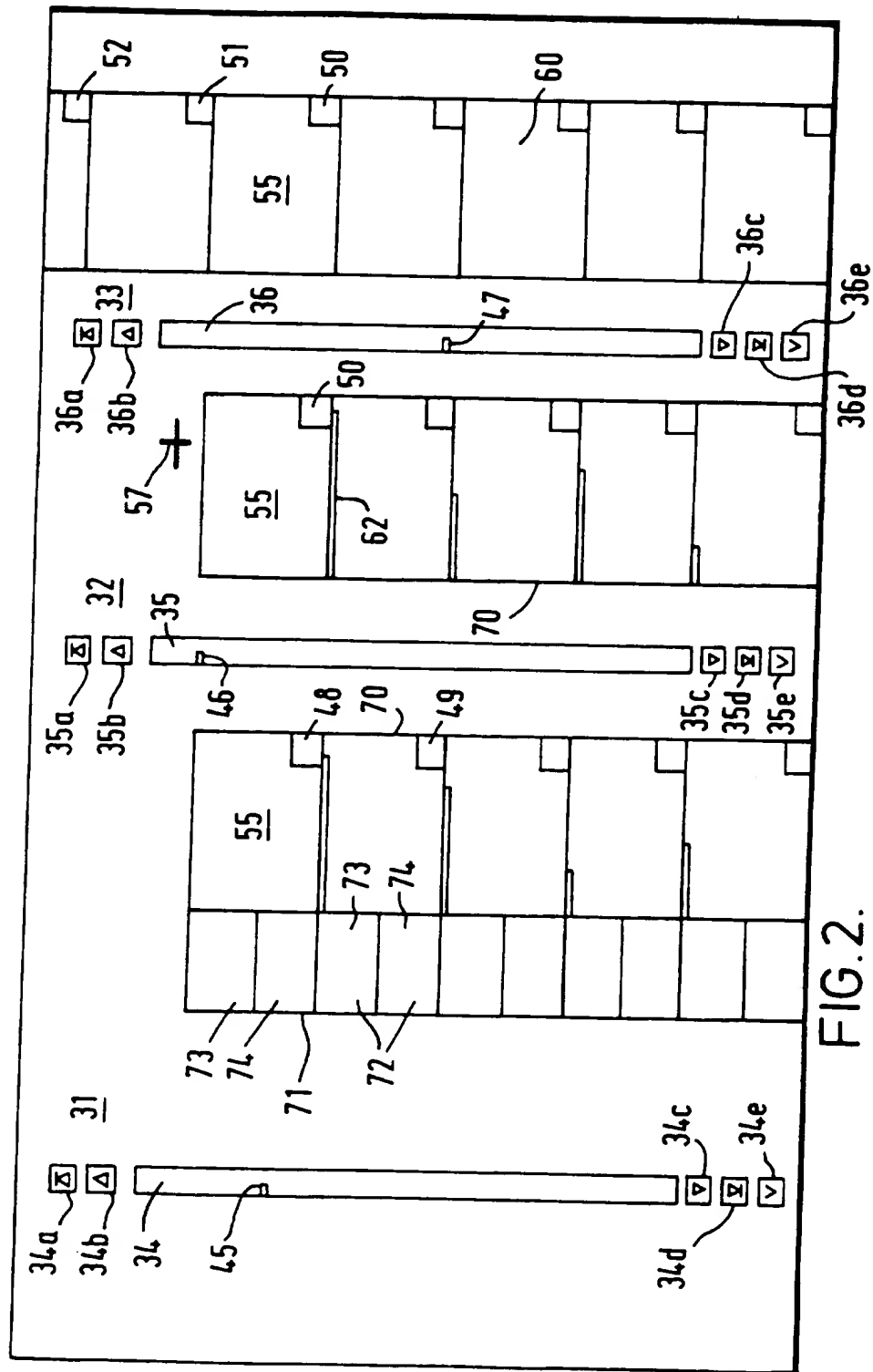


FIG. 2.

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This invention relates to an electronic video processing system.

In our co-pending British application No. 9205503.7 (publication No. 2266037) filed on 13 March 1992 and equivalent applications at the European Patent Office No. 93301889.7 (publication No. 0560624) filed on 12 March 1993, in the United States of America No. 08/030823 filed on 12 March 1993 and in Japan No. 55786/1993 filed on 15 March 1993, the contents of which are herein incorporated by reference, there is described an electronic video system for displaying a plurality of video clips having storing means for storing a multiplicity of video frames, a processor connected with said storing means, user operable input means connected with the processor and serving to enable the processor to fetch from and store in the storing means data of video frames comprising any one of said video clips, a display store connected to the processor for storing video clip frames brought by the processor from or supplied by the processor to the storing means and a monitor connected with the display store for displaying frames of video data brought by the processor to the display store.

The co-pending application and its equivalents also describes the display monitor as displaying and combining video clips in a variety of ways by user operable input means, specifically a pen and tablet, for example, by splicing, creation of dissolves etc., and in each case previewing of the combined clip is afforded so that the operator need not commit himself to a particular combination until he is completely satisfied with the form of the combined clip.

Whilst the system described in our co-pending applications referred to has proved to be commercially widely acceptable, one way in which it is capable of improvement has been identified. In using the described apparatus to assemble a story by combining and editing clips from a sequence of clips, the need to change edit points in the sequence or the order of clips in the sequence occurs frequently and involves scrolling through the

sequence of clips until the region of the sequence is displayed which contains the frame or frames at which the editing is to take place or at which the order of the clips is to be changed. This is a time consuming process which is addressed and speeded up by the present invention.

The present invention consists in an electronic video processing system for displaying video clips, comprising storing means for storing a multiplicity of video frames, a processor connected with said storing means, user operable input means connected with the processor and serving to enable the processor to fetch from and store in the storing means data of video frames comprising any one of said video clips, a display store connected to the processor for storing video clip frames brought by the processor from or supplied by the processor to the storing means and a monitor connected with the display store for displaying frames of video data brought by the processor to the display store, characterised in that the processor is enabled by operation of said user operable means to display on the monitor a video clip comprising frames brought by the processor from said storing means to the display store, to select any frame of said displayed clip and separately to display said selected frame together with indicating means which indicate the position in the displayed clip of the selected frame.

Advantageously the user operable means by causing the processor to display on the display monitor a cursor and selecting therewith the indicating means is capable of moving the cursor relatively to the indicating means thereby both to replace the selected frame with any other frame of the displayed clip and to adjust the indicating means to indicate the location of the frame which replaced the selected frame.

Suitably, the indicating means is a distinctively marked narrow strip displayed on the monitor alongside the separately displayed frame.

By a further feature of the invention, the user operable means by causing the processor to bring into the display store clips for display and to display said clips in sequence on the monitor can select for each clip a representative frame for display on the monitor separately from the associated clip and together with an associated indicating means which indicates the position of the representative frame in its associated clip.

Preferably, the displayed representative frames and their associated indicating means are displayed as a sequence of frames.

In one form of the invention the processor on instruction from the user operable means displays in an area of the monitor separate from the displayed sequence of representative frames a copy of said sequence together with, for each frame of the sequence, a pair of reduced sized frames displaying respectively the start and end frames of the clip of the associated representative frame.

Preferably, the sequence of representative frames is displayed as a column of frames with the respective indicating means displayed as narrow, distinctively marked strips between pairs of the representative frames and said reduced size frames form a column of image frames alongside the column of representative frames each pair of reduced sized images occupying the vertical height of the associated representative frame.

Suitably, the user operable means by causing the processor to display a cursor on the monitor can select with said cursor any one of the reduced sized images and by movement of the cursor relatively to the selected image can cause the selected image to sequence through the visible images of the corresponding clip and also through images beyond the visible images of the clip not used in the join between the clip and an adjoining clip.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a block diagram of a system capable of performing the present invention, and

Figure 2 illustrates a screen of a display monitor which is part of the system of Figure 1.

Referring first to Figure 1, which corresponds closely with Figure 2 of our co-pending application referred to, there is shown an electronic video processing system 10 in which video clip data is stored in a video store 11. The video data is input to the video store 11 via an input selector 12 which includes both an analog input 13 and a digital input 14 to enable data to be input in either analog or digital format from an off-line bulk storage device or library (not shown) such as a VTR. The video clip data is stored in digital form in the video store 11 and the input selector therefore comprises a suitable converter for converting the incoming clip data into the required format. The input selector 12 is connected to the video store 11 via two bi-directional data paths 15, 16 each capable of conveying a full frame of data at at least video rate to and from the video store 11.

The video store as described in our co-pending application referred to, comprises at least two disc packs, each having two disc drive devices in parallel. Each pack requires two disc drives in order to achieve the necessary bandwidth since each disc is only able to receive or output data at approximately half broadcast standard video rate.

The video store as more fully described in our co-pending application is a truly random access frame store which thereby enables frames from different video clips to be accessed in a random order for output therefrom. The provision of two bi-directional paths 15, 16 enables two frames of data to be simultaneously written to or read from the store 11 or for one frame to be written to while another is read from the store 11.

This enables a system 10 of great flexibility to be provided.

The system 10 further comprises a display store 22 which is connected via two bi-directional busses 23, 24 to the input selector 12. The display store 22 comprises a large scratch pad store for storing data relating to several frames of video and a display processor 21 for processing the frame data therein to produce respective frames of reduced size for concurrent display at different portions of a monitor 25, as will be described in greater detail hereinafter.

A video clip may be read out from the video store 11 and written directly to the display store 22 at video rate for display on the monitor 25 either at full size or at half, quarter or eighth size. Alternatively video clips may be transferred from a bulk storage library (not shown) via the input selector 12 to the display store 22. Data from the display store 22 is read by an output selector 26 and output to the monitor 25 for display. This enables the user to preview one or more video clips or to identify video clips stored off-line in a bulk store library (not shown) for transfer to the video store 11. The output selector 26 also comprises both analog and digital outputs 26a, 26b, similar to the analog and digital inputs 13, 14 of the input selector 12, to enable video clip data to be output in either analog or digital format to the bulk storage device for example.

In an editing mode of operation data relating to a plurality of video clips is read out from the video store 11 a frame at a time to the display store 22 where the data is processed before being stored so as to enable several frames to be displayed simultaneously at different, overlapping, or shared, portions of the monitor 25, as described in greater detail in our co-pending application referred to. The processed data is output from the display store in raster order for display on the monitor 25. The video store has associated with it a video processor 27 and an effects processor 28. The video processor 27 is arranged to perform such operations as generating a keying

signal, modifying colour, changing texture, and the effects processor 28 generates spatial effects such as changes of size, position and spin to one or more frames of a video clip, which operations and effects are all, *per se*, well known. Frames modified by the video processor 27 and effects processor 28 are supplied or returned to the display store 22 for display on the monitor 25.

The display store 22 also has associated with it a graphics processor 29 which enables a user to paint into each frame as described in our British Patent No. 2,089,625 and/or to create a key or stencil as described in our British Patent No. 2,113,950. The graphics processor 29 is responsive to a user operable input device such as a pen or stylus and touch tablet combination 30, as indeed are the video processor 27, the effects processor 28 and the display store processor 21.

During editing the video processor in the display store 22 is arranged to generate from the input video clips a display that represents an editing environment such as the display shown in Figure 2 of the accompanying drawings. As shown in Figure 2, the display is divided into three distinct working areas 31, 32, 33 by three so-called reel bars 34, 35 and 36.

Each reel bar 34 to 36 includes a marker 45 to 47 which is movable along the reel bar to provide an indication of the position of the displayed frames in relation to the clip as a whole and each displayed frame includes at its bottom right hand corner an information box, for example 48 to 52, to provide a further indication of the positions of the displayed frames in the video clips. The information in each box may for example be the number, i.e. position, of the frame in the clip or it may be time codes generated by a VTR when the frames were originally recorded.

A cursor 57 which is generated by selection by the pen and tablet of an icon in a menu of facilities and is moved by movement of the pen on the touch tablet is used to control

many operations performed by the system 10. The cursor is displayed by selection from a menu displayed on the monitor. One function which the cursor 57 can be used to control is that of selecting which frames from a selected clip are displayed in the working areas 31 to 33. The reel bars 34 to 36 each have associated direction control icons 34a to e, 35a to e and 36a to e. The reel bars, the control icons and the cursor are all generated by the processor 21 within the display store 22. Placing the cursor 57 over the icon 36a for example and pressing the stylus firmly on the touch tablet will cause the clip displayed in work area 33 to scroll up whilst selecting icon 36b will cause the clip to scroll up to an event, such as a join, previously defined in the clip. Similar operations are performed by selection of the other icons as will be readily apparent to those possessed of the appropriate skills. When a scrolling icon is selected data relating to the appropriate video frames in the appropriate clip are read from the video store 11 to the display store 22. The data is processed to reduce the size of each frame and the processed data is then stored at locations in the store 22 corresponding to the position of the reduced frame on the monitor 25.

Video clips such as clip 60 to be used in compiling a story are loaded from the bulk store (not shown) via the input selector 12 to the video store 11. One of the bi-directional paths, e.g. 15 is used to transfer the incoming video clip data to the video store 11 and this leaves the other path, e.g. path 16 free to transfer data relating to another video clip of the story. From the store 11, the data of the clip of the story can be read by the processor of the display store 22 into that store for display of the video on the monitor.

Once the desired clip or clips have been loaded into the video store 11 and selected frames thereof displayed on the monitor 25 the user can manipulate the clips as now described in accordance with the present invention.

After loading of the clip 60 from the store 11, alone or in sequence with other clips to be used in the story, into the display store 22 and displaying it in area 33 of the monitor, the pen and tablet or other suitable manually operable device in known manner causes the appropriate mode of operation of the display store processor to be selected for performing the present invention.

The user first selects by means of the pen and tablet 30 and the cursor 57 a frame, say frame 55, of the clip 60 as a frame which is representative of the action portrayed by the clip 60. When the cursor is located over the frame, the pen is pressed down on the tablet and such pressure attaches the cursor to the frame 50. By movement of the cursor, means of by dragging of the pen on the tablet, to the working area 32 a copy of the frame 55 appears in the area 32 together with an indicating means 61 in the form of a distinctively coloured strip 62 extending alongside the bottom edge of the frame from the left hand end thereof. The length of the strip is an indication of the location of the frame 55 in its associated clip. Thus the shorter the strip the nearer the frame 55 is located to the beginning of the clip and the longer the strip the nearer the frame 55 is located to the end of the clip.

The user can now locate the cursor by means of the pen over the right hand end of the strip and by then applying pressure to the pen and moving the pen on the tablet in the direction of the strip, the length of the strip can be varied. In changing the length of the strip the frame 55 is changed to a different frame of the clip which is located at a point in the clip which depends on the new length of the clip. By moving the cursor in this manner along the direction of the strip, the entire clip 60 can be sequenced and the image displayed can be changed to that of any other frame of the clip by lifting the pen when the desired frame is displayed.

The procedure is then repeated for further clips which are to be employed in the story to the end of providing in the working area 32 a column 70 of frames each with its own indicating strip and respectively representing the original clip 60 and the further clips. The further clips can be brought into the display store either one at a time by the display processor and displayed to provide the corresponding frame for the column 70 or they can be brought successively into the display store and attached one to the next so that the entire length of the clips forming the story can be sequentially displayed using the scrolling facility mentioned earlier.

At this juncture the clips are not necessarily in the order required for the story. To rearrange the order of the clips, the pen and tablet is manipulated to bring the cursor 57 over one of the images in the column 70 the position of the associated clip of which requires to be changed. The cursor is then attached to this image by pressing down the pen on the tablet and can then be caused to drag the attached image by movement of the pen over the tablet until the cursor is located over the junction between images of the column 70 at which the clip of the moved image is to be introduced. Release of the pressure on the pen then interposes the representative image of the clip between the images of the column at which the cursor is located. This operation is repeated as necessary on different images of the column 70 the associated clips of which have to be repositioned in the clip sequence to meet the story requirements.

It will be appreciated that the column 70 of images representative of associated clips comprises, as it were, a table of contents of the story comprised by the assembled clips and enable the user quickly to access any part of the story of interest to him.

By appropriate command, imparted by means of the pen and tablet, the processor 21 can be ordered to display in the working area 31 a copy of the column 70 of clip representative images together with a further column 71 of equally sized, reduced size

images 72, suitably eighth size images, which extend alongside the column so that for each image of the column 70, there is a pair of images 73, 74 the combined vertical height of which occupies the vertical height of the corresponding image of the column 70. The images 73, 74 are respectively the first and last of the visible images of the clip represented by the image of the column 70 adjacent the images 73, 74. By moving the cursor by means of the pen and tablet over one of the images 73, 74, e.g. the image 74, and pressing the pen down on the tablet and holding it so pressed whilst moving it from side to side the images of the corresponding clip particularly the last part thereof, can be sequenced and the point of connection of the clip to the adjoining clip thereby changed simply by releasing the pressure on the pen when the desired image appears as the image 74. The image so appearing becomes the last visible image of the corresponding clip. During sequencing of the images to change the image 74, the corresponding image in the column 70 is changed to that displayed as image 74. By performing in like manner on one of the images 73, the first visible image of the corresponding clip can be changed. Where adjoining clips forming the story have been spliced as described in connection with Figure 4 of our co-pending application referred to and its equivalents filed in Europe, USA and Japan, the disclosures of which are incorporated herein by reference, the joins between clips may involve not using a frame or frames of the clips concerned at the joins. Such frames, usually referred to as "hidden" frames can be sequenced in series with the visible frames of the associated clip when the images 73 and 74 are subjected to change as described. This gives greater flexibility when deciding where the join between clips is to take place.

Having now described the manner of performing the invention, it will be apparent that the invention provides a quick means of identifying a clip from the representative image of the clip displayed with the indicating means 61 and sequencing through it.

Also the column 70 of representative images together with their indicating means enables ready access to parts of a story formed by the series of clips without having to use the scrolling facility which by comparison is tedious. Further, a series of clips reduced to the column 70 can be rapidly re-ordered to suit the story dictates. Such advantages are obtained even before the additional facilities provided by the further column 71 of image 73 and 74 are available such facilities affording the additional advantages of initially showing the first and last visible frame of the corresponding clip, of being able to sequence through the end frames not only of the visible frames of the clip but also of those frames which adjoin the visible frames thus enabling the latter frames to be employed in the story, and, of avoiding the use of previously visible frames at a newly determined join. The determination of a new join between clips is further facilitated by the fact that as image sequencing is performed on the images 73 and/or 74 the corresponding representative image of the associated clip changes so that the image appearing as image 73 or 74 depending on which of these is being sequenced also appears as the adjoining clip representative image rendering it easier to locate a desired point at which to make a new join because the size, and therefore the resolution, of the image in the column 70 is twice that of the corresponding small sized image.

CLAIMS

- 1) An electronic video processing system for displaying video clips, comprising storing means for storing a multiplicity of video frames, a processor connected with said storing means, user operable input means connected with the processor and serving to enable the processor to fetch from and store in the storing means data of video frames comprising any one of said video clips, a display store connected to the processor for storing video clip frames brought by the processor from or supplied by the processor to the storing means and a monitor connected with the display store for displaying frames of video data brought by the processor to the display store, characterised in that the processor is enabled by operation of said user operable means to display on the monitor a video clip comprising frames brought from said storing means to the display store, to select any frame of said displayed clip and separately to display said selected frame together with indicating means which indicate the position in the displayed clip of the selected frame.
- 2) A system as claimed in claim 1, characterised in that the user operable means by causing the processor to display on the display monitor a cursor and selecting therewith the indicating means is capable of moving the cursor relatively to the indicating means thereby both to replace the selected frame with any other frame of the displayed clip and to adjust the indicating means to indicate the location of the frame which replaced the selected frame.
- 3) A system as claimed in claim 2, characterised in that the indicating means is an elongated strip and said cursor is moved lengthwise thereof to change the length of the strip.

- 4) A system as claimed in claim 1, claim 2 or claim 3, characterised in that the indicating means is a distinctively marked narrow strip displayed on the monitor alongside the separately displayed frame.
- 5) A system as claimed in any preceding claim, characterised in that the user operable means by causing the processor to bring into the display store clips for display and to display said clips in sequence on the monitor can select for each clip a representative frame for display on the monitor separately from the associated clip and together with an associated indicating means which indicates the position of the representative frame in its associated clip.
- 6) A system as claimed in claim 5, characterised in that the displayed representative frames and their associated indicating means are displayed as a sequence of frames.
- 7) A system as claimed in claim 6, characterised in that the processor on instruction from the user operable means displays in an area of the monitor separate from the displayed sequence of representative frames a copy of said sequence together with, for each frame of the sequence, a pair of reduced sized frames displaying respectively the start and end frames of the clip of the associated representative frame.
- 8) A system as claimed in claim 7, characterised in that the sequence of representative frames is displayed as a column of frames with the respective indicating means displayed as narrow, distinctively marked strips between pairs of the representative frames and said reduced size frames form a column of image frames alongside the

column of representative frames each pair of reduced sized images occupying the vertical height of the associated representative frame.

- 9) A system as claimed in claim 8, characterised in that the user operable means by causing the processor to display a cursor on the monitor can select with said cursor any one of the reduced sized images and by movement of the cursor relatively to the selected image can cause the selected image to sequence through the visible images of the corresponding clip and also through images beyond the visible images of the clip not used in the join between the clip and an adjoining clip.
- 10) A system as claimed in claim 9, characterised in that the user operable means is a pen and tablet and movement of said cursor is effected by holding the pen under pressure in contact with the tablet and moving the pen relatively to the tablet, whilst said pressure is maintained, selection of the image of the images being sequenced occurring when said pressure is relieved.
- 11) A system as claimed in any preceding claim, characterised in that there are provided access means connecting the storing means with the display store capable of transferring video data at video rate between the display store and the storing means.
- 12) A system as claimed in any preceding claim, characterised in that the processor is incorporated in the display store



The Patent Office

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Int Cl (Ed.6): H04N - 5/262, 5/265; G11B - 27/022, 27/024, 27/026, 27/028, 27/031, 27/032, 27/034, 27/34

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 5237648 (APPLE) - see fig. 2 and l. 3-25 col. 5	----

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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